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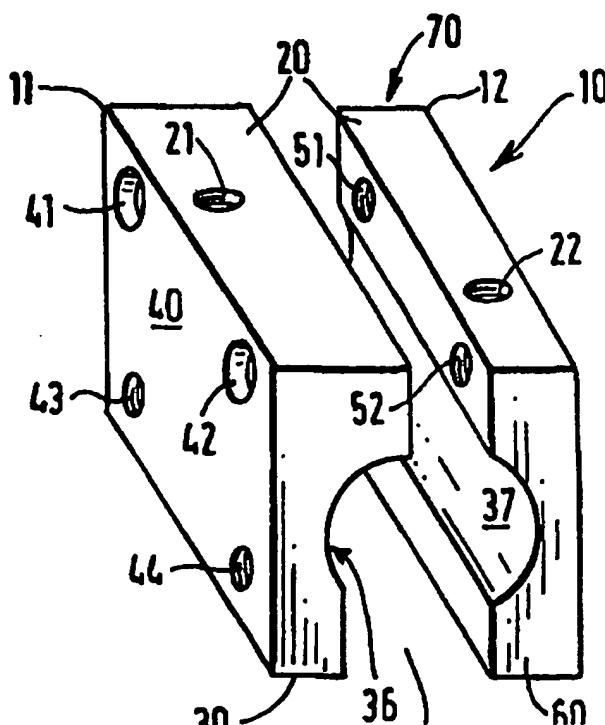
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<p>(21) International Application Number: PCT/GB99/01260</p> <p>(22) International Filing Date: 23 April 1999 (23.04.99)</p> <p>(30) Priority Data: 98303213.7 24 April 1998 (24.04.98) EP</p> <p>(71) Applicant (for all designated States except US): LATCHWAYS PLC [GB/GB]; Redman Road, Porte Marsh, Calne, Wiltshire SN11 9PL (GB).</p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only): ATKINSON, Geoffrey, Fraser [GB/GB]; 8 Jockey Lane, Bromham, Chippenham, Wiltshire SN15 2EZ (GB).</p> <p>(74) Agents: WATKINS, David et al.; Urquhart-Dykes & Lord, 91 Wimpole Street, London W1M 8AH (GB).</p>	<p>(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p>Published <i>With international search report.</i></p>	

(54) Title: **SEAM CLAMP**

(57) Abstract

A seam clamp (10) comprises a body having a substantially flat mounting surface (20) for mounting a fitting thereon, an undersurface (30) opposite said mounting surface (20), said undersurface (30) having a longitudinal slot (31) formed along its entire length and extending upwardly therefrom to define a clamp housing (35), side surfaces or flanks (40, 50) extending between said mounting surface (20) and said undersurface (30), attachment means (43, 44) for attaching the seam clamp (10) in position on a standing seam, in use, and clamping means (36, 37) in said clamp housing (35) defining a channel substantially conforming to the profile of a standing seam of a standing seam structure to which said seam clamp (10) is to be fastened, in use. The said clamping means (36, 37) are longitudinally split into two parts (11, 12, 80, 90) adapted to be clamped together in releasable fashion. The attachment means (43, 44) are disposed on said side surfaces or flanks (40, 50) at a position between said undersurface (30) and said standing seam.



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SEAM CLAMP

The present invention relates to a fitting for lightweight panel structures and, in particular, to a so-called "seam clamp" or "seam block" adapted for attachment to the raised seam of a lightweight standing seam panel structure and for mounting ancillary equipment thereon.

5 Nowadays, it is quite commonplace for buildings to be constructed from lightweight panelling attached to structural elements such as girders and braces. This can be a very quick method of construction, even for large structures such as warehouses and/or storage sheds. Large pre-formed panels can be used for the cladding and a building under construction is quickly
10 transformed from a basic skeleton of steelwork to a completely enclosed structure.

Typically, the cladding sheets are formed from an aluminum alloy, only a few millimetres in thickness. Large sheets of thin material are inherently quite flexible and, in order to stiffen the cladding sheets to improve their
15 suitability for building cladding, the sheet edges are rolled or otherwise pre-formed to create a standing seam. Adjacent sheets can be formed with complementary formations that interengage to form a weather-proof joint.

Thus, the strength of the cladding is partly attributable to the seam formation.

20 If it is necessary to attach permanent or semi-permanent fittings to the cladding, two possible approaches can be used. Firstly, a reinforcing plate can be attached to the cladding by bolts, rivets or similar fastenings. Preferably, reinforcement is attached on both sides of the cladding, but this may not always be possible if the interior surface is inaccessible. The desired fitting can
25 then be attached to the reinforcing plate by any suitable means. United States Patent No. 5,287,944 discloses an anchor for a fall arrest system bolted to the panel of a building roof through an integrally-formed reinforcing plate.

One drawback of this approach is that the integrity of the cladding panel is compromised by the creation of fixing holes for attachment of the reinforcing

plate or plates. Another disadvantage is that the reinforcing plate probably has to remain in position after the fitting is removed. Otherwise, the fixings holes for the reinforcing plate have to be patched to maintain the weather soundness of the structure. Also, removal of the reinforcing plate may leave an inherent weakness in the cladding at the site of removal.

An alternative approach is to use a seam clamp adapted to be engaged on the standing seam previously described. Known seam clamps are unitary elements having a recess in one face thereof configured to conform to the profile of the seam. The seam clamp is mounted on the seam at one of the seam ends at the edge of a pair of panels, and slid into position before being fastened with clamping screws or the like. The side faces or the upper surface of the seam clamp may be configured to receive fittings mounted thereon in a releasable fashion by means, such as threaded fasteners, well known in the art.

The advantage of this second approach to the mounting of fittings on lightweight cladding is that the seam clamp is attached to an inherently strong part of the cladding. Also, removal of the seam clamp does not require repair or patching of the cladding at the site of removal.

One disadvantage with many known seam clamps is that they must be mounted on the seam at one of the seam ends and slid into position. In large building structures, the seam may be very long and it is inconvenient for the fitter to have to slide the seam clamp into position over a vast expanse of cladding. This becomes particularly inconvenient and time-consuming if a number of seam clamps is required to support each fitting and a multiplicity of fittings is required to be mounted. This can arise, for example, in such circumstances as the retrospective fitting of a height safety system to an existing lightweight clad building.

It is therefore an object of the present invention to provide a seam clamp which is easily attached to and removed from a standing seam in a lightweight standing seam panel structure at any point on the seam between its ends. It is a further object of the present invention to provide a seam clamp which is adapted to be affixed to a variety of seam profiles.

The invention is a seam clamp comprising a body having a substantially flat mounting surface for mounting a fitting thereon, an undersurface opposite said mounting surface, said undersurface having a longitudinal slot formed along its entire length and extending upwardly therefrom to define a clamp housing, side surfaces or flanks extending between said mounting surface and said undersurface, attachment means for attaching the seam clamp in position on a standing seam, in use, and clamping means in said clamp housing defining a channel substantially conforming to the profile of a standing seam of a standing seam structure to which said seam clamp is to be fastened, in use, said clamping means being longitudinally split into two parts adapted to be clamped together in releasable fashion;

characterised in that said attachment means are disposed on said side surfaces or flanks at a position between said undersurface and said standing seam.

Preferably, the clamping means is integrally formed with the body, such that the body is longitudinally split into two parts, each part forming one half of the clamping means.

The so-called "mounting surface" of the seam clamp is preferably provided with mounting means, such as threaded holes, for the attachment of permanent or semi-permanent fittings which it is desired to mount on the panel structure.

In an alternative embodiment, the longitudinal slot may be over-size and the seam clamp may be provided with shims or inserts adapted to conform to the profile of the particular standing seam to which it is intended to secure the seam clamp. This approach gives greater flexibility in design, since a standard seam clamp can be used for a variety of seam profiles. All that is required is for the installer to use inserts of an appropriate geometry to match the seam profile. To ensure correct alignment between the parts of the seam clamp and the inserts, the internal surface of the slot and the external surface of an insert may be provided with complementary keying formations that interengage when the respective parts are correctly oriented with respect to each other. For example, the internal surface of the seam clamp part defining the slot may be

formed with a recess and the external surface of the insert may be formed with a protruding lug of matching dimensions to the recess. Alternatively, the lug and recess could be formed on the seam clamp part and insert, respectively. Several such formations could be formed on one surface, if desired, and a non-symmetrical pattern of formations could be used to ensure that the insert is installed in position the right way up. This could be particularly important if the standing seam to which the seam clamp is to be secured is "handed".

Preferably, the side surfaces or flanks of the seam clamp, which lie adjacent to the undersurface in which the slot is formed, extend substantially parallel to the longitudinal slot and are provided with fastening means for fastening the two parts of the clamping means together. The side surfaces or flanks may also be provided with attachment means for fastening the seam clamp in position on a standing seam, in use.

The fastening means may be a pair of alignable through-holes extending transversely through the respective parts, between the longitudinal slot and the mounting surface of the seam clamp. The through-holes may be plain, and the two parts of the seam clamp may be fastened together by a nut and bolt arrangement using the flanks as thrust surfaces. Alternatively, one of the holes may be threaded to receive the threaded end of a fastener such as a hexagonally-headed bolt or the like. Another alternative is to use fasteners with slotted or recessed heads, in which case the holes may have a counterbore to accommodate the fastener heads, so that the flanks of the seam clamp are substantially uncluttered by protruding elements.

Similarly, the attachment means may comprise a combination of threaded fasteners and holes extending transversely through one or both parts of the clamping means. In the embodiment in which the seam clamp body is split into two parts each forming one half of the clamping means, at least one of the parts should have a threaded hole or a plurality of threaded holes adapted to receive bolts having a complementary screw thread, these bolts serving to fasten the seam clamp in position on a standing seam, in use. It is only necessary for one of the parts to be clamped on the seam, since the other part is secured to this first part by the fastening means discussed above.

However, both parts may be clamped to the seam, if desired, for added security and to minimise localised stress concentration.

In the alternative embodiment in which the clamping means is constituted by inserts, transverse holes are provided in the inserts in register with the transverse holes in the flanks of the seam clamp. The holes in the flanks of the seam clamp need not be threaded provided that the corresponding holes in the inserts are threaded.

The invention will now be described by way of example only with reference to the drawings, in which:

- 10 Figure 1 is a perspective view of a seam clamp in accordance with a first embodiment of the present invention;
- Figure 2 is a front elevation of one of the flank surfaces of the seam clamp depicted in Figure 1;
- Figure 3 is a plan view showing the top surface of the seam clamp depicted in Figure 1;
- 15 Figure 4 is an end view showing an end surface of the seam clamp depicted in Figure 1, and
- Figure 5 is an exploded perspective view of an alternative seam clamp, in accordance with a second embodiment of the present invention.
- 20

Referring firstly to Figure 1, here is shown a seam clamp generally represented by the reference numeral 10. It is a generally cuboid structure with six substantially flat surfaces in orthogonal relationship to adjacent surfaces, and is shown here in an exploded view with its two parts 11, 12 slightly separated from each other. Typically, the seam clamp 10 is machined from an aluminium alloy.

Referring now to Figures 2 to 4 in addition to Figure 1, upper surface 20 is the mounting surface on which a permanent or temporary fitting may be mounted by means of bolts (not shown) threaded into screw-threaded mounting holes 21, 22.

Undersurface 30 includes a longitudinal slot 31 extending the entire length of the seam clamp 10 from one end surface 60 to the other end surface 70. The slot 31 protrudes into the body of the seam clamp 10 and, as best seen in Figure 4, has opposing gripping surfaces 36, 37 which constitute the gripping means of the seam clamp. The slot is enlarged at its innermost portion to define a channel or clamp housing 35 which is similar in cross-sectional outline to the profile of a keyhole. The cross-sectional shape of the clamp housing 35 is chosen to match the profile of a standing seam of a standing seam panel structure to which the seam clamp is intended to be fastened, in use.

Figures 1 and 2 show the side surface or flank 40 of one of the parts 11 of the seam clamp 10. Side surface 40 is provided with four through-holes 41, 42, 43 and 44. The through-holes 41, 42 nearest the upper surface 20 are not threaded and are provided with a counterbore 41a, 42a to receive the head of a fastener such as a threaded bolt (not shown). Figures 1 and 4 show corresponding through-holes 51, 52 in the upper portion of the other part 12 of the seam clamp 10. Through-holes 51, 52 are internally screw-threaded and receive the threaded ends of the fasteners inserted into through-holes 41, 42 in the part 11, thereby enabling the parts 11, 12 to be fastened together. The bottom of the counterbore 41a, 42a acts as a thrust surface for the head of the bolt in its respective through-hole.

Body part 12 has no holes corresponding to the through-holes 43, 44 formed in the lower half of body part 11. Through-holes 43, 44 are internally screw-threaded and, in use, they receive a threaded bolt or grub screw which fastens the seam clamp to an upstanding seam of a standing seam panel structure.

The sequence of fitting the seam clamp 10 to a standing seam is as follows: Firstly, the body parts 11, 12 are offered to a standing seam in the approximate location where the seam clamp 10 is to be fastened and positioned with one of the gripping surfaces 36, 37 on either side of the seam. Then threaded fasteners are inserted into through-holes 41, 42 in the body part 11 and screwed home into internally screw-threaded through-holes 51, 52 in

the body part 12. The seam clamp 10 then straddles the seam, but is capable of being slid in relation thereto to its final position. Once the seam clamp 10 is positioned where it is intended to be fastened, threaded bolts or grub screws are inserted into internally screw-threaded through holes 43, 44 and screwed home until their ends engage the standing seam to effect fastening of the seam clamp 10 thereto.

The seam-clamp thus-fastened is then ready to receive a permanent or temporary fitting bolted to its top surface 20.

Turning now to Figure 5, this shows a second embodiment of the invention in exploded perspective view. Like reference numerals have been used to denote features of the second embodiment which correspond to features described above in relation to Figures 1 to 4. It is not proposed to describe those features a second time.

In figure 5, a seam clamp 10 is depicted in perspective view which comprises a unitary body 13 having an upper surface 20, an undersurface 30 and side surfaces 60, 70, only one of which is visible in this view. Undersurface 30 is provided with a longitudinal slot 31 extending the entire length of the unitary body 13. The slot has a pair of side surfaces 32, 33 and a root surface 34, the surfaces 32, 33 and 34 defining a clamp housing 35. The clamp housing 35 is much larger than the profile of the standing seam to which the seam clamp 10 is intended to be fastened, in use.

The seam clamp 10 also comprises a pair of insert members 80, 90 which are adapted to be butted together at their upper portions 81, 91, and which have opposing gripping surfaces 86, 96 on their lower portions. The gripping surfaces constitute the gripping means of the seam clamp and they define a channel 85 between them which is similar in cross-sectional outline to the profile of a keyhole. The cross-sectional shape of the channel 85 is chosen to match the profile of a standing seam of a standing seam panel structure to which the seam clamp is intended to be fastened, in use.

The insert members 80, 90, when butted together at their upper portions 81, 91, are dimensioned to be received in the clamp housing 35.

As depicted in Figure 5, the left-hand insert member 81 has a pair of threaded holes 83, 84 extending transversely therethrough which are positioned to be in register with through-holes 43, 44 formed in the left hand flank 40 of the unitary body 13.

5 The left hand insert member 81 has a lug 88 protruding from its left hand flank surface. Similarly, the right hand insert member 90 has a lug 98 protruding from its right hand flank surface. The lug 98 is shown in dotted outline in the Figure. The lugs 88, 98 are received in notches formed in the side surfaces 32, 33 of the clamp housing 35. Only one notch 33a is shown
10 in the Figure. The notches are intended to ensure correct alignment of the insert members 80, 90 in the clamp housing 35 in the fully-assembled seam clamp 10. A non-symmetrical pattern of lugs and notches could be used to ensure that the insert members 80, 90 are installed in position the right way up and the right way round. This could be particularly important if the standing
15 seam to which the seam clamp 10 is to be secured is "handed".

 The sequence of fitting the seam clamp 10 to a standing seam is as follows: Firstly, the insert members 80, 90 are offered to a standing seam in the approximate location where the seam clamp 10 is to be fastened. The insert members 80, 90 are positioned with one of the gripping surfaces 86, 96
20 on either side of the seam and their upper portions 81, 91 butted together. The unitary body member is then positioned over the insert members 80, 90 such that the protruding lugs 88, 98 are received in respective notches. Threaded bolts or grub screws are inserted into through-holes 43, 44 and lightly screwed into the internally screw-threaded holes 83, 84 of the left-hand
25 insert member 80.

 In this condition, the loosely-assembled seam clamp 10 straddles the seam, but is capable of being slid in relation thereto to its final position. Once the seam clamp 10 is positioned where it is intended to be fastened, the threaded bolts or grub screws are screwed home until their ends engage the
30 standing seam to effect fastening of the seam clamp 10 thereto.

 The seam-clamp thus-fastened is then ready to receive a permanent or temporary fitting bolted to its top surface 20.

In another variant, not illustrated, a split body as described above in relation to Figures 1 to 4, but having an over-size slot in its undersurface, may be used in combination with a pair of insert members as described above in relation to Figure 5.

- 5 In circumstances in which a plurality of seam clamps 10 must be fastened to a large panel structure, the advantages of being able to install the seam clamps at or very near their final positions will be readily apparent.

10 Although the invention has been particularly described above with reference to preferred embodiments, it will be appreciated by persons skilled in the art that variations and modifications are possible without departing from the scope of the claims which follow.

CLAIMS

1. A seam clamp (10) comprising a body having a substantially flat mounting surface (20) for mounting a fitting thereon, an undersurface (30) opposite said mounting surface (20), said undersurface (30) having a longitudinal slot (31) formed along its entire length and extending upwardly therefrom to define a clamp housing (35), side surfaces or flanks (40, 50) extending between said mounting surface (20) and said undersurface (30), attachment means (43, 44) for attaching the seam clamp (10) in position on a standing seam, in use, and clamping means (36, 37) in said clamp housing (35) defining a channel substantially conforming to the profile of a standing seam of a standing seam structure to which said seam clamp (10) is to be fastened, in use, said clamping means (36, 37) being longitudinally split into two parts (11, 12, 80, 90) adapted to be clamped together in releasable fashion;

characterised in that said attachment means (43, 44) are disposed on said side surfaces or flanks (40, 50) at a position between said undersurface (30) and said standing seam.

2. A seam clamp (10) as claimed in claim 1 wherein said clamping means (36, 37) is integrally formed with said body and wherein said body is longitudinally split into two parts (11, 12), each part forming one half of said clamping means (36, 37).

3. A seam clamp (10) as claimed in claim 1 wherein the longitudinal slot (31) is over-size in relation to the dimensions of the standing seam to which it is intended to be fastened in use and wherein the seam clamp (10) is provided with insert means (80, 90) adapted to conform to the profile of the particular standing seam to which the seam clamp (10) is intended to be fastened.

4. A seam clamp (10) as claimed in claim 3 wherein the internal surfaces (32, 33) of the seam clamp parts defining the slot (31) and the external surfaces of respective inserts (80, 90) are provided with complementary keying formations (88, 98, 33a) that interengage when the seam clamp parts (13) and inserts (80, 90) are correctly oriented with respect to each other.

5. A seam clamp (10) as claimed in claim 4 wherein the internal surface (33) of a seam clamp part defining one side of the slot (31) is formed with a recess (33A) and the external surface of a complementary insert (90) is formed with a protruding lug (98) of matching dimensions to the recess (33A).

6. A seam clamp (10) as claimed in claim 4 or claim 5 wherein several such formations are provided in a non-symmetrical pattern to ensure correct orientation of the inserts (80, 90) relative to the seam clamp parts.

7. A seam clamp (10) as claimed in any preceding claim wherein the mounting surface (20) is provided with mounting means (21, 22) for the attachment of permanent or temporary fittings.

8. A seam clamp (10) as claimed in any preceding claim wherein the side surfaces or flanks (40, 50) of the seam clamp (10) are provided with fastening means (41, 42, 51, 52) for fastening the two parts of the clamping means together.

9. A seam clamp (10) as claimed in claim 8 wherein holes in the side surfaces or flanks (40, 50) of the seam clamp (10) have a counterbore to accommodate the head of a respective fastener so that the flanks (40, 50) of the seam clamp (10) are substantially uncluttered by protruding elements.

FIG. 1

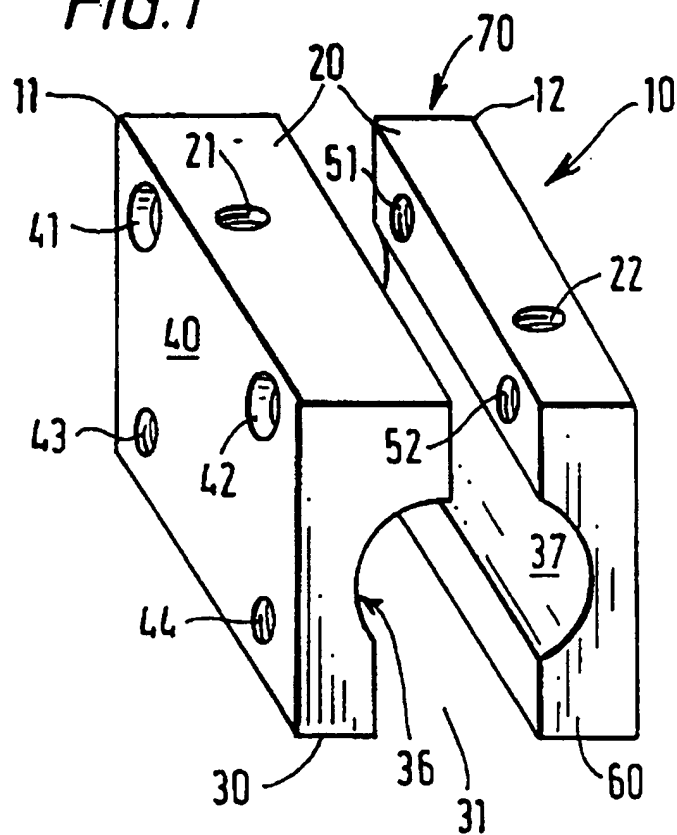


FIG. 2

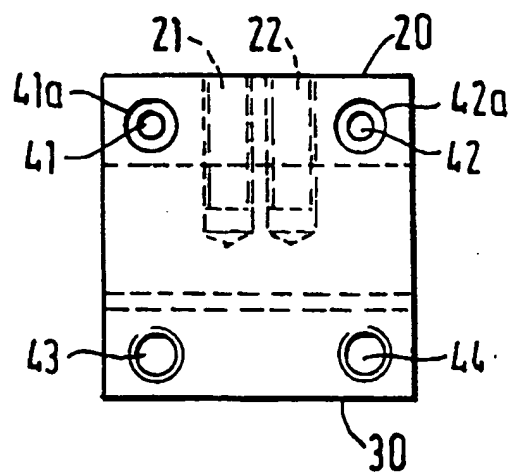


FIG. 3

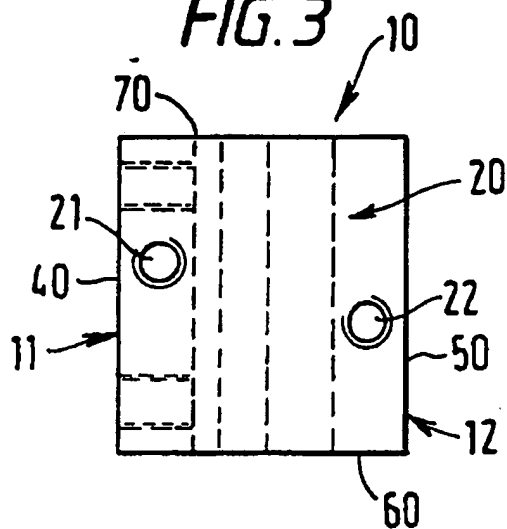
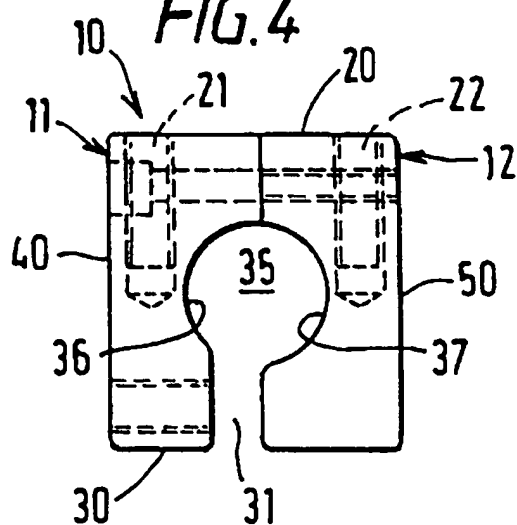


FIG. 4



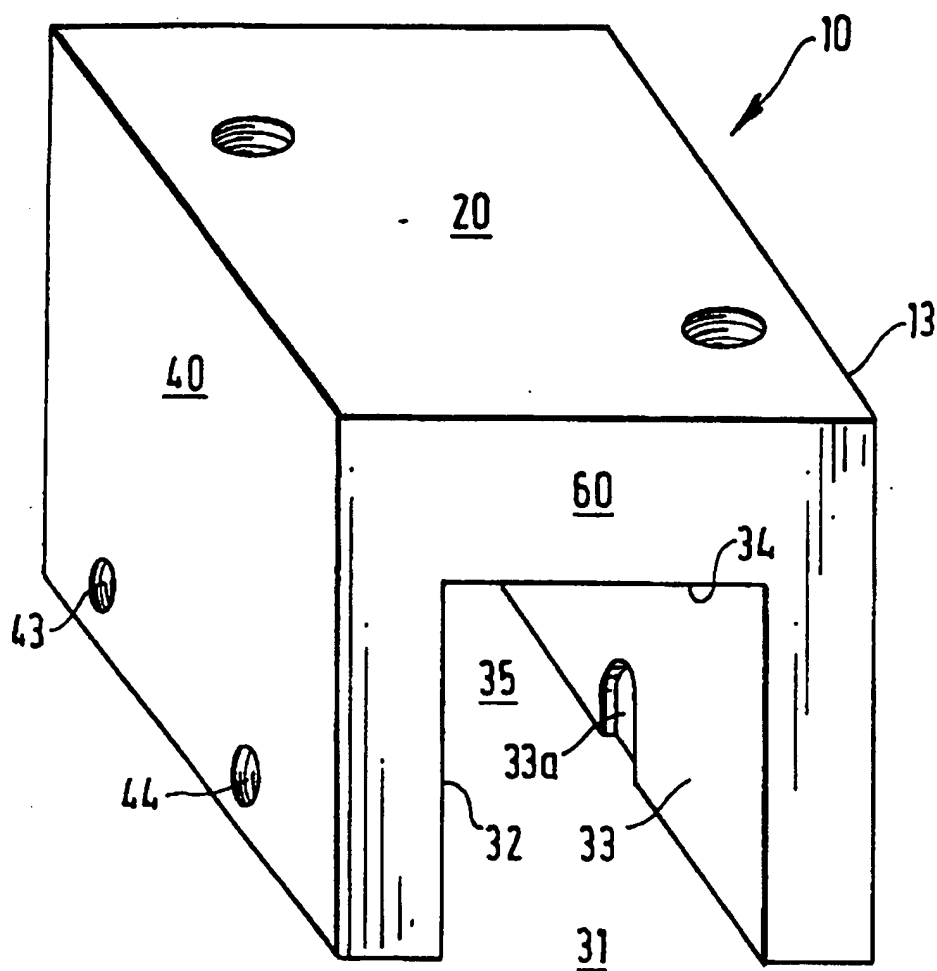
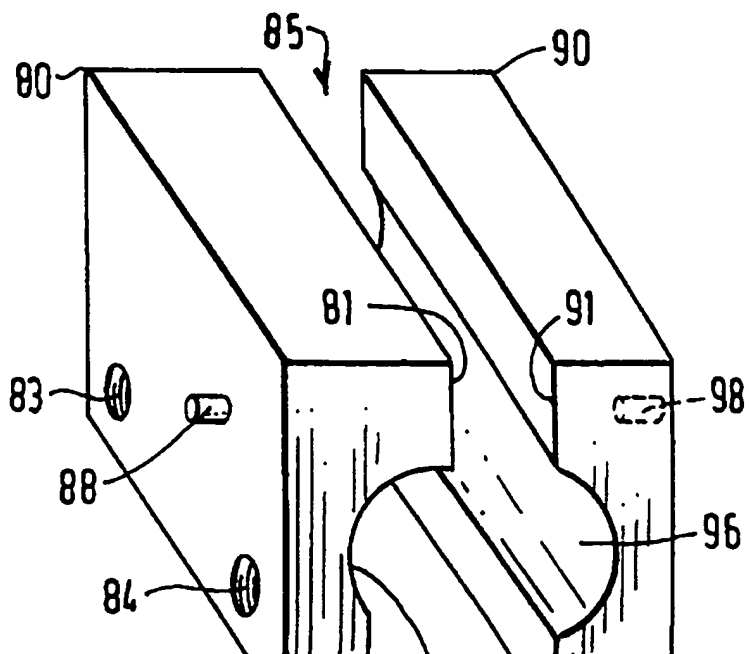


FIG.5



INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/01260

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 E04D3/362 E04D13/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 E04D E04F E04H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 569 324 A (BUTLER MANUFACTURING CO) 10 November 1993 see the whole document ---	1-3
X	FR 2 638 772 A (MECATECHNIX SARL) 11 May 1990 see page 5, line 18 - page 7, line 6 see figures 1,5 ---	1,2,7
A	US 5 596 858 A (JORDAN FRANKLIN F) 28 January 1997 see the whole document ---	1,3,8
A	US 4 546 586 A (KNUDSON GARY A) 15 October 1985 see the whole document -----	1,3

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0569324 A	10-11-1993	US 5222340 A	29-06-1993
		CA 2094310 A,C	05-11-1993
		DE 69311848 D	07-08-1997
		DE 69311848 T	02-01-1998
		JP 2558426 B	27-11-1996
		JP 6026155 A	01-02-1994
FR 2638772 A	11-05-1990	NONE	
US 5596858 A	28-01-1997	CA 2184862 A	25-05-1997
US 4546586 A	15-10-1985	CA 1221219 A	05-05-1987